APPENDIX C

Groundwater Protection Assessment

C.1 INTRODUCTION

The objective of the groundwater protection assessment was to evaluate whether existing chemical concentrations in on-site shallow soils (within the upper 12 feet of soil) have the potential to degrade underlying groundwater quality. Even though shallow groundwater beneath and in proximity to the subject parcel is not used as a domestic water supply, the LARWQCB requested, as a conservative measure, that an evaluation be conducted of potential downward chemical migration from soil resulting in possible degradation of the Bellflower aquitard. The Bellflower aquitard is the most shallow water-bearing zone beneath the subject parcel. This evaluation conservatively (and unrealistically) assumes that the Bellflower aquitard is a part of the underlying aquifers providing domestic water supply. As described below, the assessment was conducted by further assuming a conservative scenario regarding chemical migration and mixing in groundwater following approved USEPA and LARWQCB methodology and assumptions.

The maximum and mean concentrations of each chemical detected in soil that has a California drinking water standard were compared to site-specific SSLs derived from California drinking water standards, specifically primary or secondary MCLs. Estimates of mean concentrations were derived from available sample data and are defined as the 95% UCL of the arithmetic mean. Initial site-specific SSLs were derived using the following formula presented in Section 2.5 of the USEPA document entitled *Soil Screening Guidance: Technical Background Document (TBD),* dated July 1996:

$$\text{Initial SSL} = \text{MCL}\ [(K_{oc} * f_{oc}) + ((O_w + O_a * H')/P_b)] \qquad \text{(Equation 1)}$$

Where:

Initial SSL = soil screening level, mg/kg;
MCL = maximum contaminant level, mg/L;
K_{oc} = soil organic carbon-water partition coefficient, L/kg;
f_{oc} = organic carbon content of soil, kg/kg;
O_w = water-filled soil porosity, L_{water}/L_{soil};
O_a = air-filled soil porosity, L_{air}/L_{soil};
H' = Henry's law constant, dimensionless; and
P_b = dry soil bulk density, kg/L.

Site-specific geotechnical parameters are presented in Table 15 of the soil investigation report. The above equation is a partitioning formula, which does not account for chemical attenuation during migration in soil or mixing with groundwater. To better represent contaminant migration in the soil column, an attenuation factor of 13 was applied to the initial SSLs for VOCs. For non-VOCs, attenuation factors were derived using the formulas presented in Appendix A of LARWQCB's May 1996 *Interim Site Assessment & Cleanup Guidebook* (Table C-1). Both attenuation factors were derived assuming site-specific average soil particle size distributions of 30 percent sand, 57 percent silt, and 13 percent clay, and a distance of 53 feet from soil impacts

to the groundwater table. This distance is considered to be appropriate because the depth to groundwater at the site is approximately 65 feet bgs, and the maximum COPC depth addressed in this analysis is 12 feet bgs.

A USEPA default dilution attenuation factor (DAF) of 20 was applied to the initial SSL to account for limited groundwater mixing. This default value is presented in the above-referenced July 1996 USEPA document, and was used by USEPA to develop generic SSLs. The resulting site-specific SSL is equal to the initial SSL (assuming no soil attenuation or groundwater mixing) multiplied by the product of a soil attenuation factor (e.g. 13 for VOCs) and a groundwater mixing factor of 20 (Table C-1).

The maximum detected concentrations in shallow soil at Parcel C are below the respective SSLs in all but one chemical (selenium). For selenium, the SSL is 8.6 mg/kg and the maximum detected concentration is shallow soil was 14.0 mg/kg. When SSLs are compared against mean concentrations (estimated using the 95%UCL) all of the COPCs (including selenium) fall below their respective site-specific SSLs. Assuming that the mean concentration of a chemical in shallow soil provides a reasonable estimate of vadose zone conditions, then this analysis shows that the residual concentrations of chemicals remaining in the upper 12 feet of soil at Parcel C do not pose a threat to groundwater quality at levels greater than MCLs.

TABLE C-1
COMPARISON OF SOIL SCREENING LEVELS TO MAXIMUM SOIL CONCENTRATIONS AND 95% UCL
Boeing Realty Corporation Former C-6 Facility
Parcel C
Los Angeles, California

Analyte	SSL	Max Concentration in Soil (0-12 feet bgs)	Mean Concentration in Soil (95% UCL)
	(mg/kg)	(mg/kg)	(mg/kg)
Aroclor 1248	8.29E+01	1.10E-01	1.88E-02
Aroclor 1254	8.29E+01	2.30E-01	2.12E-02
Aroclor 1260	8.29E+01	9.30E-01	6.02E-02
Arsenic	2.74E+02	2.35E+01	3.33E+00
Benzo(a)pyrene	3.59E+03	6.10E+00	2.65E-01
Beryllium	1.61E+04	1.80E+00	5.40E-01
Cadmium	1.82E+02	5.29E+01	3.40E-01
Carbon tetrachloride	7.01E-02	1.80E-03	3.57E-03
Copper	1.18E+06	1.10E+03	2.40E+01
1,1 - Dichloroethane (1,1-DCA)	3.89E-01	2.40E-02	3.60E-03
1,2-Dichloroethane	3.31E-02	4.60E-03	3.55E-03
1,1-Dichloroethene	7.26E-01	2.20E-01	4.69E-03
cis-1,2-Dichloroethylene (cis 1,2-DCE)	4.32E-01	1.40E-01	3.79E-03
Ethylbenzene	7.50E+01	1.10E+01	2.93E-02
Hexachlorobenzene	5.31E+00	1.20E-01	1.37E-01
Lead	1.04E+04	1.02E+03	9.89E+00
Mercury	3.51E+01	6.00E-01	5.00E-02
Methyl tert-butyl ether	7.80E-01	2.10E-02	3.94E-03
Selenium	8.63E+00	1.40E+01	6.50E-01
Silver	4.63E+01	4.20E+00	4.70E-01
Tetrachloroethene	6.98E-01	1.60E-01	4.01E-03
Thallium	6.53E+01	3.00E+00	1.52E+00
Toluene	1.42E+01	1.20E+00	5.98E-03
1,2,4-Trichlorobenzene	2.46E+01	4.00E-03	1.23E-02
1,1,1-Trichloroethane (1,1,1-TCA)	2.31E+01	9.30E-01	6.70E-03
1,1,2 - TCA	3.62E-01	6.40E-03	3.56E-03
Trichloroethylene	4.69E-01	3.40E-01	9.87E-03
Xylene (total)	1.86E+02	1.19E+02	2.65E-01

Notes:
UCL = Upper confidence level
SSL = Site-specific soil screening level
mg/kg = milligrams per kilogram